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FINAL REPORT
OF THE
EARLY WARNING AND MONITORING SYSTEM (EWAMS) PROJECT

By

Frederick A. Rothe
International Public Policy Research Corporation
McLean, Virginia

January 1982

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Introduction

→ The Early Warning and Monitoring System (EWAMS) project has ended. With it ends the World Event Interaction Survey (WEIS) data collection---the longest running day-to-day international politics data collection of its type. The two projects (WEIS and EWAMS) are closely connected. WEIS was the "basic" research forerunner to the "applied" EWAMS. WEIS data, concepts, computer technology, indicators, and statistical techniques were implemented in the EWAMS project. Five years ago, the EWAMS project was initiated, eleven years after the WEIS project collected its first data. The main idea for the EWAMS project was to transfer all that had been learned, built, collected, and produced in a university setting to a government foreign affairs setting. Then, as now, the basic thought was far reaching and exciting; a product (WEIS) developed with government funds in an academic setting for theoretical concerns would potentially be used by foreign affairs personnel with very definite practical policy concerns. The bridge between theory and practice was going to be constructed.

→ Despite all the excitement, the computer time, the government funding, and the brain trust assembled to undertake this task, the bridge between theory and practice was never actually built. Many reasons for this exist. The main purpose of this Final Report is to outline some of those reasons. This is done so that future projects of this type will be better prepared for some of the obstacles, for which avenues not to take, and for which mistakes not to repeat. It is important to keep in mind that the EWAMS was successful, but that the final goal of bridging theory and practice proved elusive.

Setting the stage for this report will be a brief review of the World Event Interaction Survey (WEIS). No assessment of EWAMS is complete without an explicit statement connecting WEIS to EWAMS. Following that will be a brief review of the

EWAMS project. Following the EWAMS review will be the heart of this report---a section of recommendations. None of these sections, hopefully, will be particularly lengthy. So much writing has emerged from these projects that it would be a disservice to all the able researchers to attempt to distill their efforts. Rather, this report emphasizes what has happened in the course of the EWAMS project, and what should happen if there is ever another vast undertaking of its kind.

The World Event Interaction Survey (WEIS)

Premier Krag DEN declared that DEN would welcome Scandinavian appeal to UNK and USSR to reopen Geneva Conference

This is the first event of the WEIS data collection. Insignificant when placed in the sweep of international political history, it marked on January 1, 1966, a significant achievement: the ability to "make data" on the day-to-day activities of world politics. Often overlooked today (simply because the data have been used so often), making data in this fashion was, and is, a considerable accomplishment. With the data came the ability to examine propositions of international relations. Systems theory and systems thinking were prevalent in the international relations field at this time, and the data were made "to make clothes for the naked systems body" (McClelland, 1976: 108).

The systems perspective guided the conceptualization for the collection of the data and the systems perspective also organized the analytical tasks. While the WEIS data are well known, the particular conceptualization of the data and the rationale for making the data are often not well known and are rarely understood.¹ Stated quickly and simplistically, the

¹For explanation of the conceptualization see the many writings of Charles McClelland. Also, see McClelland et al. (1971), Beal (1975), and Rothe (1979).

WEIS data are designed to represent international relations, or the words and deeds that tie together the nations of the world, as these relations move through time. The guiding preposition of the WEIS endeavor has always been that the past character of international relations is the best determinant of the present character of international relations. Change over time is the crucial factor in the WEIS orientation; understanding patterns of change, sequences of relations, and the dynamics of world politics are the heart of the WEIS analytical task.

International crises are a preoccupation of this systemic orientation to world politics analysis. Crises are dramatic changes in the ongoing routine of international affairs. Crises are often conceived as the turning point between peace and war, or, perhaps more insightfully, the moment in time that presents both opportunity and danger. In other words, crises mark a change in foreign affairs, and the characteristics of these changes are interesting to international affairs system analysts.

To analyze international crises, the hard won data were made into indicators. These indicators were designed to monitor world political activity. Only 200 nations and other prominent international actors comprise the international system. Since there are so few (statistically speaking) entities to analyze, the analytical task was primarily one of accounting or monitoring. Keeping track of how the relations generated by the 200 or so international actors altered, led to crisis, amplified, dampened, converged, and moved away from crisis was the central WEIS task. It was a challenging task, even with the array of indicators (z-scores, H-rel, volume) that were employed. Furthermore, sophisticated analytical methods were employed. Time series analysis, exponential smoothing, Markov chains, harmonic analysis, digraph theory, and pattern recognition techniques were all used to analyze the data and the indicators, to try to understand and to anticipate change.

To do all this (enter, update, validate, and manage the data, construct the indicators, subject the data or indicators to analytical methods) and to do it all fast required computers. Because of the data management and analytical requirements, special computer software had to be built. Recall that the data are for every nation in the world, for every day, for every one of twenty-two event types. Any of these factors had to be easily manipulated to meet the analytical tasks. Because of these factors, standard statistical packages (e.g., BMDP, SPSS, SAS, TSP, OSIRIS, etc.) were inadequate for the task. Computing, therefore, is another integral component of the entire WEIS technology, and one that is too often taken for granted. Without computing, none of the data, none of the indicators, none of the experiments with new analytical methods (new to international relations), and none of the basic research activities would have been completed. Using computing technology for the analysis of international politics was one of the advances made by the WEIS project.

If the WEIS project had one major shortcoming, it was that the WEIS researchers did not allocate enough time and effort to analyzing completely the data. So much time was spent on data making and management, computer application and invention, and general experimentation with so much that was so new, that not enough time was spent analyzing notions and concepts from the international relations systems perspective. No longer is so much time required to make and maintain the data. Advances in computing technology have liberated the researchers from their earlier time consuming tasks.

The WEIS project had accomplished what it had proposed to do: it offered systems theoretic conceptions for the analysis of international relations; it made the data necessary for examining these conceptions; it designed and built advanced (for the field of international relations) computer software; it created

conceptually supported indicators; it marshalled a full array of analytical techniques to analyze the data and indicators; it experimented with forecasting methods appropriate for the data structure; it conducted many analyses on the evolution of historical international crises; it examined the dynamics of the politics among nations; and it produced many reports on all of these facets.

Despite its shortcomings, the WEIS project developed a technology for analyzing international crises and the change characteristics of international politics. The entire technology (data, computer configuration, computer programs, automated analytical routines) held the promise of being used in government foreign affairs settings to help analyze and anticipate international trouble and danger. Personnel in the Defense Advanced Research Projects Agency (DARPA), the primary funding agency for WEIS, recognized this promise and sought to transfer the technology from an academic institution to a government/policy setting. This technology transfer became the Early Warning and Monitoring System (EWAMS) Project.

The Early Warning and Monitoring System (EWAMS)

The Early Warning and Monitoring System (EWAMS) was a bold idea. The idea was to take advanced technology and make it available to those government personnel involved in the perennially difficult and constant task of crisis anticipation and crisis management. Because the WEIS technology was often used to analyze the onset of international crises, it was viewed as the logical choice to bring into the policy environment. Severe obstacles to the successful transfer of the technology were present at the beginning of the EWAMS endeavor.²

²EWAMS was one component of the DARPA Crisis Management program. Some of the other components will be touched on briefly in the main text of this paper.

These obstacles will be outlined briefly, so the accomplishment of the EWAMS will be more fully understood.

The obstacles facing the EWAMS fell roughly into four categories: computing machinery or hardware; computer programs or software; data analysis and display; and training and/or education for the prospective users of the entire EWAMS package. Each of these four broad categories will be discussed in turn.

The WEIS technology had been developed over a number of years on several different computers. The version of the technology to be transferred to the EWAMS project was designed, built, and tested on a large mainframe computer, an IBM 370. While an IBM of this size may be "perfect" for the various needs of a university, it simply was "too much" for the computing requirements of the Crisis Management programs. Furthermore, an IBM 370 is a very expensive machine, compared with other machines that could do the job. DARPA selected a Digital Equipment Company (DEC) PDP 11/70, a very capable but less expensive computer. At the time of the decision to acquire this DEC equipment, similar DEC computers were in widespread use throughout the defense community. This fact (the widespread use of DEC equipment) was important because it would lessen the difficulties of EWAMS technology transfers within the defense community. Thus, once the initial transfer from university to government was made, future transfers within the government would be much easier.

The decision to use DEC computers affected the computer software. WEIS software was in PL/1. An extremely powerful programming language, PL/1 at the time of the WEIS transfer (about 1976), was used only on IBM computers. All computer software, therefore, had to be written in American National Standard (ANS) FORTRAN. While all the basic concepts, organization, and algorithms were well established in the PL/1 version

of the software, the actual code of the software had to be changed enough to accommodate the differences between the two different programming languages. For instance, PL/1 is extremely powerful for managing textual information; FORTRAN is not. Because of the amount of text in the WEIS data, special effort was required to rewrite in FORTRAN the text manipulation components of the WEIS technology. Stated most directly, the transfer of computer programs from one computer language to another is not a simple task; it is long and arduous. And because the entire remainder of the project depended upon the accuracy of those programs, special care had to be taken.

To those uninitiated in computer technology, the discussion on computer hardware and software may seem trivial. After all, the uninitiated often believe "a computer is a computer is a computer." This is not quite true, and because it is not quite true, the amount of effort, time, and talent required to complete successfully the software and hardware conversion should not be underestimated. However, this accomplishment, no matter how considerable, only provided the foundation for the remainder of the EWAMS project.

Data analysis and display was the third obstacle for the EWAMS project. At the WEIS project, data were analyzed in a two step process. First, the researcher, using the WEISUM program, would retrieve the desired data. WEISUM permitted the user to manipulate any of the variables (time, actor, event, target) in virtually any fashion. The end result would be a two dimensional table. Second, the researcher, using statistical packages or individually designed software, would analyze the data in the two dimensional table. All indicators, analyses and statistical manipulation took place after the WEISUM results.

Clearly, this process was too complex for the prospective user. People using WEISUM had years of experience with this type of quantitative political analysis. Prospective users of

EWAMS probably had no experience with quantitative political analysis. All data analysis, indicator construction, and manipulation of variables had to be done more or less by EWAMS. The EWAMS that the prospective analyst would use would have to be simplified enough to allow the user to make few decisions, press few buttons, and have little interaction with the computing machinery or the statistical techniques. In other words, EWAMS had to be very "user friendly."

In addition to this requirement, the analytical focus had to be shifted. WEIS researchers were interested in international system analyses; prospective users of EWAMS (primarily the defense and intelligence communities) were not concerned with such grandiose, even abstract, analyses. Their need was to know simply when one country was doing something to another. EWAMS, therefore, had to emphasize dyadic or country-pair analyses. Country-pair analysis had gained a certain amount of popularity in academic work, particularly with those researchers associated with the comparative foreign policy movement (Kegley, et al., 1975; McGowan and Shapiro, 1973; and Roseneau, 1974, 1976). Emphasis on dyads violated the conceptual orientation of the WEIS endeavor, however. Because of the prospective user community of the EWAMS, this conceptual violation was required. If the violation had not occurred, it is doubtful if the EWAMS idea would have ever been received in the applied setting.

Similarly, indicators of international political activity had to be constructed so that they would make intuitive sense, at the very least, to the potential user. WEIS researchers commonly used such indicators as "event flow" or simply total activity. While total activity is an EWAMS indicator, other indicators, such as Tension and Cooperation and Conflict, had to be incorporated. Although no theoretical reasons exist for bifurcating total event activity into cooperative and conflict categories (Fitzsimmons, et al., 1969: 9-10), it was necessary

in order to make the EWAMS more user-oriented. Such adjustments had to be made during the transfer to the applied setting.

In addition to these adjustments, changes had to be made in data display. To repeat what was mentioned previously, the WEISUM program placed the raw data in a two dimensional table; all graphic representation of the data, indicator construction, and statistical analysis took place in a second step, after considerable user interaction with the various components of the computer (graphics packages, statistical packages, individually designed software). Thus, the EWAMS had to make all these factors "self-contained," or part of the EWAMS package. Raw data and all indicators were placed in tabular form, and all plots of the data and indicators had to be accessed simply by making a selection from a graphics menu. It was not an inconsiderable accomplishment to place all these factors into one computer program.

Much time and effort was devoted to these technical aspects of the transfer. With so much attention allocated to the technical aspects, the training and education of the prospective users were often overlooked. With hindsight, the reasons for the inattention to such an important aspect of a technology transfer are obvious. All the people (DARPA personnel, university professors, private industry contractors) involved in the research and development of the EWAMS, were accustomed to using and interacting with computers to do political analyses. Indeed, to those who use computers for political analysis, this "user-machine" interface is almost second nature. Such was not the case for the prospective users of the EWAMS.

At the outset of the EWAMS project, DARPA targeted the intelligence community as potential users of the EWAMS. That decision made good sense; current intelligence personnel are tasked with keeping account of current political activities and anticipating future developments. From an academic perspective, this

was the task of the WEIS project. The "fit" appeared to be good. Also, the intelligence community tends to be more technology oriented than other government departments specializing in foreign affairs. This familiarity with computing technology would ease, hopefully, the transfer and use of the EWAMS.

A major obstacle was that many of the intelligence analysts who would be experimenting with the EWAMS were on two year tours of duty. Often they would be assigned to areas of the world with which they had no familiarity. In addition to learning their new jobs, they were asked to learn EWAMS. They received all EWAMS documentation and they, or their supervisors, often received demonstrations of the entire EWAMS package. But they never received the tutelage necessary to introduce them to such a new technology.

Computerized political analysis was foreign to many intelligence analysts; many analysts thought, and probably still think, that it is impossible to analyze the nuances of international affairs by using numbers and computers. In these instances of well entrenched and well intentioned skepticism, training is particularly important. In these instances, the idea of "man-machine" interface often means coaxing the analyst to turn on the computer terminal and to experiment with a menu-driven, user-friendly program. Other problems (e.g., the source of the data) occurred during the transfer of the EWAMS to the user community, but a thorough training and education program may have helped alleviate some of the difficulties. More will be said about this in the Recommendations section.

Assessment of the EWAMS Project

The EWAMS project was neither a spectacular success nor a dismal failure. It succeeded in many technical areas, but it failed in its intent to transfer the technology throughout the defense and intelligence communities. In many ways, EWAMS, even

though it had been in existence for close to 16 years altogether (WEIS and EWAMS), was ahead of its time for the applied policy setting. This is flattering to the basic thrust of the EWAMS, but is critical to the manner in which EWAMS was presented to potential users. If anything, EWAMS was "oversold" to prospective users. Also, the technology was not carefully tailored to the precise needs of the defense community. Before expanding on this, some of the accomplishments of the EWAMS will be briefly reviewed.

Most importantly, EWAMS overcame all the obstacles outlined in the previous section. All the data and software were placed on the DEC PDP 11/70 and made relatively easy to use. "Menus" were presented to the analyst so a minimum of computer familiarity was required to access the data and do analyses. Data entry had progressed to the point where one individual could read the data source, code the appropriate items, enter the data on the computer, and update it so it could be used by analysts within hours. Tremendous amounts of time were saved by the technological advances. Labor intensive data making practices of the WEIS project had been eliminated by the EWAMS project.

Because of the "menu driven" aspect of the EWAMS, data analysis could progress with few computing complications. All indicators for any country pair or group of countries for any time interval (day, week, month, quarter, year) were displayed in a neat tabular format. The EWAMS was designed to eliminate any extra computer manipulation or computer space for additional statistical packages.

Researchers on the project were tasked with developing new indicators and new methods for analyzing world politics. Constraining the task was the need to make these methods and indicators as easy to use and to understand as possible. Often these research undertakings would be long and complex, yet would be

presented simply and with "intuitive appeal."³ Other indicators developed for groups of nations other than specific regions, called Threat Networks (Rothe, 1981) and the entire international system (Rothe, 1980b) were developed within these constraints. Although time did not permit these indicators to be placed in the EWAMS, they attempted to complete the need to have indicators for the entire indicator hierarchy (single nations, country pairs, regions, and the world).

The computing advances, research that tested existing indicators and developed new ones, and research to develop new methods of international political analysis comprise the EWAMS as it exists today on DARPA's Demonstration and Development Facility (DDF). But the entire EWAMS endeavor encompassed much more; it stimulated other efforts with data sources and computing machinery. Some of these efforts are discussed next.

As was mentioned earlier, a major task of the EWAMS project was to transfer the EWAMS to other users. The European Command (EUCOM) of the Joint Chiefs of Staff in Germany requested the EWAMS and the transfer took place. Because of the location (Germany) of the user, the transfer was not a matter of simply copying the data and software and installing it on another DEC computer. The software had to be written, again, in BASIC and placed on a computer tape cartridge. This cartridge was then inserted in a Tektronix stand alone "smart" terminal. Daily data updates took place by transferring the data from DARPA's DDF by way of the ARPANET to the terminal in Germany. Once again, this was a considerable technological achievement: data entered from a terminal in McLean, Virginia, to a computer in Rosslyn, Virginia, were then sent to a "mini-EWAMS" package in Germany.

³Paul Rossa's work (1979b) is a good example of sophisticated research that was placed in the EWAMS in a very straightforward manner.

Other transfers took place. But these transfers involved moving the software and data to another similar computer, or permitting analysts to use the DARPA facility computer. The Germany transfer gave evidence that such complex transfers could be done and that smaller, cheaper, yet powerful computers could be used to do the job. Another component of the Germany transfer was a weekly analysis of world politics, sent to Germany from Virginia, by way of the ARPANET. This weekly report was one aspect of the "real-time" testing and evaluation done for the EWAMS project.

Both the WEIS and EWAMS projects had established convincing track records for their analyses of historical international crises. Never had the data been kept current to do real-time analyses, however. Since the EWAMS was intended to aid current intelligence activities, the EWAMS project was tasked with doing current or real-time analysis and actually making projections about where trouble in the world may next appear.

Documented in several research memoranda (Rossa, 1979a; Rothe, 1980a; Hopple and Rothe, 1980) and numerous ARPANET messages, the real-time testing proved moderately successful. The EWAMS tended to be as accurate in its prognostications as a panel of judges (Hopple and Rothe, 1980). This finding supported the idea that an automated intelligence system could locate trouble as well as experienced individuals, thus emphasizing the labor saving advantages of an automated system. The Recommendation section of this report will offer some suggestions on how the real-time aspect could be improved.

One of the criticisms often voiced about the EWAMS, during the transfers, the real-time task and in general, was the nature of the data in the EWAMS. EWAMS used open public sources; primarily the New York Times, but also the Manchester Guardian, The Times of London, and later the Foreign Broadcast Information

Service. The rationale for using the world class newspapers extended beyond the simple fact that they were available on a daily basis to the WEIS and EWAMS projects. Very briefly, newspapers were used because:

- Newspapers provide the open, public account of international politics or the truly political phenomena that can be used by international statesmen to affect or influence public awareness of international activity;
- Newspapers have institutionalized the practice of picking up a story as it develops or real-time reporting;
- Newspapers provide an editing function that eliminates trivial matters and emphasizes what is pertinent to their readers; and
- Newspapers, through their editing function and real-time reporting function, serve as the first "coders" for data collection by eliminating "noise" from the data and emphasizing what is salient, which usually means dangerous or uncertain, for their readers.

In many ways, therefore, newspapers were the ideal source for analyzing international crises and anticipating changes in world politics. But because newspapers are open sources, many potential users of EWAMS were skeptical of their utility and felt the need to have classified sources used in the EWAMS. Also, EWAMS covered only the activity that goes on between two nations, not within a single nation. Other developments in the EWAMS project were the data collection and examination of the Reuter's newswire and the data collection of political activity within African nations. The Reuters data collection efforts were brief and very labor intensive; without the editing function of a newspaper much extraneous and redundant information had to be sifted and discarded. For these reasons, the Reuter source proved to have little utility.

The African data collection effort became known as the African Warning and Monitoring System (AWAMS) Project. Although international data were collected for the African nations, the main research task was to transfer the WEIS event coding

scheme to national political action. In addition, the Foreign Broadcast Information Service (FBIS) African report was the primary data source. The Manchester Guardian and The Times of London were also used as sources. Computer technology was adjusted to accommodate the requirements of internal political analysis, but all other indicators and analytical techniques were borrowed from EWAMS.

Just how successful the AWAMS was is difficult to ascertain. Not enough time was available to complete the necessary examination of this new research undertaking. Certainly, more conceptual work on the nature of internal instability and crisis is required to organize the research. Several tests were undertaken, however, to compare the two sources (FBIS and the English newspapers). The basic finding (Prokop, 1981a, 1981b, 1981c) was that the two sources are quite different in their coverage of individual nations, prominent actors within those nations, and political action among the sub-national actors. These differences could aid analysts to select the source of data for their particular needs. Also, the African data were never real-time to permit the exploration of their utility for current intelligence requirements.

Complementing the AWAMS project was another portion of the crisis management program. Under the direction of Robert Slater of MATHTECH, this project used the EWAMS/AWAMS computer technology and data collection schemes on classified cable traffic. Because that project was classified little more can be said about it here. In personal conversation with the author, however, Slater emphasized how terribly time consuming and labor intensive was the data collection task. Timeliness is crucial to the applied environment. Until improved methods, such as computer assistance to a data coder, can be used on classified data, it is doubtful whether classified information has much utility for this type of automated quantitative political analysis.

Selection of a good source has always been a difficult problem.⁴ Selection of a source depends largely on the design and purpose of the research. In the applied setting, the demands are different, of course. For example, if applied research was ever used at the very highest levels (cabinet level and above in the United States) of the foreign policy community, the New York Times may be very useful. Decision makers at that level are keenly attuned to the public record of their foreign policy efforts and the efforts of their counterparts in foreign lands. But other than that high level or other foreign affairs experts who appreciate the need to monitor the open, public record of foreign affairs, sources such as the New York Times may not be well received.

Classified sources, therefore, appear to be the best source to use as long as the target of the technology transfer is the intelligence community. But unless data can be made quickly and readily from these sources, the timeliness of the data is lost. EWAMS computing technology is adequate for the task of maintaining real-time or "perishable" information, but only if the information can be made machine acceptable. No doubt the source problem will continue to confound applied research efforts of this sort.

To summarize, the EWAMS project made considerable progress in the effort to become installed in actual government settings. However, the accomplishments were primarily technological. Rebuilding all the EWAMS software in BASIC and making it run on a "smart" terminal on another continent is a technological achievement. But the EWAMS project never really took hold in government settings. Reasons for this are discussed next.

⁴The source debate raged for some time in academic circles. For a good summary see the appropriate chapters in Roseneau (1974) and Azar and Ben-Dak (1975).

Recommendations

A contributing factor of why EWAMS was not accepted by the user community is the way in which it was presented to prospective users. It was often presented as a genuine forecasting device that would tell the user, simply by pressing the return key on the terminal, where international trouble would occur next. This was met with considerable skepticism and was also not quite true. An experienced quantitative analyst could derive projections from the EWAMS. But there are few intelligence analysts with this type of quantitative computer based experience. Furthermore, the EWAMS itself contained no quantitative forecasting methods. DARPA's Crisis Management Program did experiment with forecasting methods (Duncan and Job, 1980), but these were never part of the EWAMS. Forecasting or making projections is an important function of an intelligence analyst's job. The credibility of the EWAMS project was severely damaged when it was advertised as an automated forecasting device, but contained no automated forecasts and relied on the analyst, not the computer, to make the forecasts.

Other problems also existed for the EWAMS and its mission of transfer. These problems are the heart of this section. These problems fall roughly in to four categories. After listing them, each will be discussed in more detail. These problems, or recommendations for future projects are:

- Conceptual or theoretical work based on the needs of the prospective user community;
- Training, education, and interaction with the user community;
- Advanced computer technology, primarily graphics, which present data in a more simplified, user-oriented fashion; and
- Additional foreign affairs information included as part of one computerized system.

As outlined in this report, the hallmark of the EWAMS project was its technological achievements and experimentation with alternative data sources. Missing from the EWAMS project was a strong conceptual foundation of the government analyst. WEIS had strong conceptual bearings and these were incorporated in the EWAMS. But it is very possible that prospective users of the EWAMS cared little about the WEIS orientation and had their own notions of how the world works. It may be that during the EWAMS project the technological cart preceded the conceptual horse. Ideas drive technology, and then, once the technology is in place, the two (ideas and technology) become more symbiotic. A sound theory of applied warning and a sound theory of applied monitoring were required. So much emphasis was placed on computing and other technical matters, that little time was allocated to understanding how the government analyst viewed his or her task.

Many important conceptual questions still need to be answered. For the foreign affairs or intelligence practitioner, what characterizes warning? Is warning a simple deviation from the normal routine or does it involve more? If warning involves more, what are the other factors? Are global or regional conditions crucial or are strictly localized conditions the only matter of concern? Is warning based simply on the familiarity of the "target" for which the analyst is responsible? If so, what constitutes that familiarity---history, personalities, social or economic conditions? How does warning differ from not warning or monitoring? What factors constitute monitoring? How is time used in warning? Do analysts think in terms of days, weeks, or months, or do they think in terms of a perishable present and an indefinite future?

Clearly, the answers to these questions affect the technology and data that are placed before the analyst. It may be that the warning task is very individualized, in which case, the computer programs would have to include questions as to the

specific needs of the analyst. Answers to the questions would then automatically adjust indicators, data, and time increments to account for that analyst's preferences.

Transferring a conceptual orientation from a university research environment to a policy environment was an excellent beginning. But it was not enough. The needs, goals, and preferences of each setting are different. Just as computer software and the analytical orientation had to be changed to accommodate the policy environment, so must the conceptual orientation that guides the direction of research and development. Unfortunately, it is common in this era of technological revolution that technology is placed before thought. At the outset of the EWAMS project, if more thought had been allocated to the requirements of the prospective users, a product more accommodating of the user's needs may have been delivered. Although often described as the best automated intelligence system of its kind, the EWAMS was poorly understood, rarely used in-depth, and not widely transferred.

To do this conceptual thinking involves the second recommendation: researchers responsible for the development of the project must be able to interact with the users of the technology. Analysts themselves, obviously, have little time to think through and articulate the conceptual notions or guidelines they employ to do their job. It is the responsibility of the researcher to uncover what the orientation of the analyst is, or what the guidelines are that permit the analysts to find what they are looking for. It is not a question of what the analyst wants from the EWAMS, but a question of how the analyst does his or her job. It is a simple recommendation, but one that was never implemented during the EWAMS project. Researchers, not just government program managers, must have frequent discussions with, and direct access to, the potential user. A rapport should be established so government analysts and contract researchers can understand each others' demands and requirements.

Certainly, the real-time tests undertaken in the course of the EWAMS project would have benefitted from such interaction. At the time of those tests, no theory of real-time analysis was available to guide the analysis. Special software was built to aid the analysis, but there was no way of knowing if the software and the general thrust of the tests ever came close to simulating the intelligence analyst environment. From the research and development perspective, the tests yielded reasonable results. But the test results did not indicate if the general orientation to real-time analysis would be appropriate for the current intelligence analyst.

Training and education in the use of a computerized political analysis system must take place. The interaction between the user and research communities must be supplemented by training sessions. Because users aid researchers in the design of a system does not mean that the users will be comfortable with the final product. Stated earlier, computing technology is still novel, even threatening, to many analysts in foreign affairs. Training sessions not only will educate the prospective user, but they will afford those in the research community the opportunity to learn how such systems can be corrected, adjusted, and tailored for the user community. Because this topic was covered earlier, it is important now only to emphasize that new technologies, no matter how suitable they may be for prospective users, require careful introduction and thorough instruction.

The third recommendation is to urge the application of more advanced computing techniques. Although the EWAMS is a very good package, it does not use state-of-the-art computing capabilities. EWAMS is an automated version of what an international affairs analyst does by hand. Because it is fast at data retrieval and display, it is a labor saving device. For example, if an analyst collected all the interactions between the United States and the Soviet Union over a six month time span, separated the interactions

according to event types, calculated the various indicators, and did all this by hand, the entire task would take months, and probably would not be correct. Automating this process is the strength of computers. The speed of data retrieval and calculation, and the enormous storage capacity of a computer provides the analyst with extended memory. Fast computer analysis often sparks in the analyst additional questions and provides the analyst additional insight. It is in this fashion---the quick examination of constantly unfolding questions---that make computers an extension of human intelligence.

New computer technology serves this function, of course. The major achievement of some of the new technology is the way in which the user views information or uses the computer. Two such computing advances are the Decision Information Display System (DIDS) and the Spatial Data Management System (SDMS). DIDS was designed and built for the Federal Government by General Software Corporation. Very briefly, DIDS is a very fast high resolution computer mapping system. It includes maps of the United States by county and the world by country. It includes bivariate displays, such as United States county population by per capita income, time sequencing image display, and zooming and cursor control. The novelty of DIDS is that it permits data analysis through color changes or differences on the map. In other words, data are presented as colors, rather than numbers. Because of the speed with which the maps can be displayed and the very high resolution of the displays, DIDS is an extremely powerful analytical tool.

SDMS was developed at the Massachusetts Institute of Technology, with DARPA funding, and resides on DARPA's computing facility (DDF). The novelty of SDMS is that it permits the user to move into, out of, and around information simply by moving a manual control ("joystick"). Instead of laboring arduously over a computer terminal keyboard, the analyst simply moves to a data location, much like walking down a library aisle, and

views the desired data. At least two factors make SDMS novel. One is that any medium of information can be placed on the SDMS---pictures, text, or numbers can be placed on a single system. Second, already discussed, is the ability to move around in information spaces simply by manipulating a small lever.

The genius of these computer advances is their simplicity of data display. Complex in hardware and software configuration, and currently very expensive, DIDS and SDMS have managed to reduce computing complexity to very simple, straightforward data presentation. To watch international crises evolve by color changes of nations (in DIDS) has much more impact than trying to decipher columns of numbers. This is particularly true for analysts who may not have quantitative political analysis experience.

DIDS and SDMS are too expensive at this time for widespread use. But computing advances, particularly in the graphics realm, are made almost daily. The point is, therefore, that future quantitative political research should incorporate the advances made in the graphics or visual presentation of information. During all of the WEIS project and most of the EWAMS project, such powerful graphic techniques were not available. Now that the techniques are available, they should be embraced by quantitative political researchers. As always, however, the conceptual orientation of the research should guide the implementation of the new technology.

The final recommendation is to include more foreign affairs information on a single computer system. Here, the emphasis is on different types of information, not just additional manipulation (indicators) of one type of information (event interaction data). International event data are just one aspect of foreign affairs analysis. National event data, national decision makers, alliance structures, policy position and history,

and many other facets are all factors influencing the flow of international affairs. An integrated international affairs data system is the goal of collecting additional information. Next is a list of some of the additional information that should be placed on a more complete data management system.⁵

- International Event File
- Country Event Files
- Country Attribute Files
- Biographic File: Leader, Elites
- Policy or Position File
- Episode File
- Commitment File: Treaties, Agreements, Dependency Factors
- International Transactions File
- Opinion, Attitude, Image File
- Intelligence Organizations File
- Military Dispositions File
- Special Operations File

The EWAMS project provided the international event file and a country event file (AWAMS) for African countries. The Threat Recognition and Analysis (TR and A) Project at the University of Southern California, which was part of DARPA's Crisis Management Program, constructed country attribute files and commitment files (McClelland, et al., 1976; McClelland, 1975). Studies have already been initiated to offer the government analyst a more complete foreign affairs information. Precisely what is in each of these files should be determined through the interaction between government analysts and the researchers responsible for the product.

⁵This list is taken from McClelland, et al. (1971: 63).

Initially, this list appears intimidating. Indeed, this list may not even be complete. Other files may have to be incorporated as events or trends warrant. But this is a case that more information is better. Criticisms were often voiced that EWAMS did not contain enough information of different types to be truly useful. By collecting this information a more complete foreign affairs information system would be available to analysts. Furthermore, various academic researchers have already examined many of the ideas that are represented by the various files; conceptual work has already been done to help organize the data collection.

With previous research and experience available, data collection for these files is a straightforward, albeit time consuming, operation. Posing a different problem is how to manage and present the information once it is computerized. Most ideal, perhaps, and least threatening is to develop these files one at a time as individual modules. DARPA's Crisis Management Program has already initiated this effort with its EWAMS, AWAMS, TR and A, and MATHTECH projects. But if all these data collections were placed on one computerized system, using current EWAMS technology, accessing the data would be unwieldy and difficult.

The SDMS technology may help solve this problem. Recall that SDMS permits the user to move around in different data locations. An analyst, for example, could start an information search in a specific country and view national event data, then move over to the leader and elites file, then to the commitment file, and so on, all within the same country. Using SDMS in this capacity is not a novel idea. In the course of the EWAMS project it had been discussed, but not enough time was available for the implementation.

After all the years of effort allocated to the WEIS and EWAMS projects, recommendations for increased theoretical thinking, more data collections, training and education of prospective users, and using the latest computer technology, may almost sound trivial.

But these recommendations are constant reminders of the ever-present difficulties of taking a technology from a university and transferring it to a setting where the technology is new and virtually unknown. Because of this difficulty (of introducing established academic research to government personnel who are often totally unaware of the established research) future transfers should view their established research as having a new beginning, but with different organizing questions, with different "hypotheses," with access to the most advanced computer graphics, perhaps with other data, and certainly with the suggestions of those who actually will be using the technology.

A final recommendation is this: future applied research efforts must realize that the purpose of the research is to produce a product that, hopefully, will be used by policy practitioners. The requirements of this product are entirely different than those for producing a paper for publication or presentation at a conference. Researchers involved in the transfer must be aware of the difference between applied research (a usable product) and basic research (a publishable paper). Awareness and practice of this difference should be the driving force behind all future applied research efforts.

Conclusion

The EWAMS project was a bold idea. And the project did what it proposed to do: it made data; it invented new indicators; it developed user-friendly (menu driven) software; it experimented with real-time analysis; and it produced many reports and much documentation. But it did not build the bridge between theory and practice. For this reason it is not being continued. Lack of managerial experience and intellectual inventiveness in this form of bridge building was the main obstacle to the project.

The EWAMS project should serve as a model for future efforts. Its accomplishments are outlined in the numerous writings of the

project, and this Final Report has outlined some of its shortcomings. Indeed, the EWAMS itself is best viewed as a model; it offered to potential users one concrete method for automating international political analysis. If nothing else, EWAMS gave to the user community one technology that could be changed, altered, or modified as necessary to meet the needs of that particular community.

Until that time when government foreign affairs analysts are comfortable with and well versed in quantitative computer-based international affairs analysis, future research projects will probably meet the same fate as the EWAMS. But this does not mean that these projects should not be attempted. The science (quantitative approach) of international relations is barely two and a half decades old, a very short life when compared to the "hard" sciences. Like the hard sciences, much more work needs to be done for applications to be made. Future research efforts, therefore, should be encouraged. Viewed correctly, the EWAMS project was just the first step in applying some of the knowledge gained by international affairs research. More steps need to be taken.

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